

CLAIMS

What is claimed is:

1. A fiber optic module comprising:  
 a pull-actuator to disengage and withdraw the fiber optic module from a cage assembly; and  
 one or more electro-optic transducers to convert optical signals into electrical signals or electrical signals into optical signals.

2. The fiber optic module of claim 1 wherein the fiber optic module is a small form pluggable (SFP) fiber optic module and the cage assembly is a small form pluggable (SFP) cage assembly.

3. The fiber optic module of claim 1 wherein the pull-actuator is activated to disengage and withdraw the fiber optic module by a single backward pull action.

4. The fiber optic module of claim 1 wherein the pull-actuator includes one or more grooves to slideably engage the fiber optic module.

5. The fiber optic module of claim 1 wherein the fiber optic module includes one or more grooves to slideably engage the pull-actuator.

6. The fiber optic module of claim 1 wherein the pull-actuator slides to disengage the fiber optic module from the cage assembly.

1           7.    The fiber optic module of claim 1 wherein  
2           the pull-actuator includes,  
3                one or more end-stops to withdraw the fiber optic  
4   module as the pull-actuator is pulled.

1           8.    The fiber optic module of claim 1 wherein  
2           the pull-actuator includes  
3                one or more end-stops to prevent the pull-actuator  
4   from becoming disengaged from the fiber optic module as it is  
5   pulled.

1           9.    The fiber optic module of claim 1 wherein  
2           the pull-actuator includes  
3                a pull-tab,  
4                a shaft coupled to the pull tab at a first end, and  
5                an opening at a second end of the shaft to engage a  
6   first end of a pivot arm.

1           10.   The fiber optic module of claim 1 wherein the pull-  
2   actuator includes  
3                an orientation indicator to indicate the fiber optic  
4   module which the pull-actuator releases.

1           11.   The fiber optic module of claim 1 wherein  
2           the pull-actuator is formed of metal.

1           12.   The fiber optic module of claim 1 wherein  
2           the pull-actuator is formed of a plastic.

1           13.   The fiber optic module of claim 1 further  
2   comprising:

a pivot-arm actuator, pivotally coupled to the fiber optic module, to release the fiber optic module from the cage assembly when the pull-actuator is pulled.

14. The fiber optic module of claim 13 wherein the pivot-arm actuator further includes, a pivoting pin to rotationally couple the pivot-arm actuator to the fiber optic module.

15. The fiber optic module of claim 13 wherein the pivot-arm actuator includes a first engaging end to engage to the cage assembly, a second engaging end to engage to the pull-actuator, and a shaft coupling to the first and second engaging ends.

16. The fiber optic module of claim 15 wherein the first engaging end includes a keeper to engage the fiber optic module to the cage assembly.

17. The fiber optic module of claim 15 wherein the first engaging end includes a latch to engage the fiber optic module to the cage assembly.

18. The fiber optic module of claim 15 wherein the second engaging end includes a keeper to engage the pivot-arm actuator to the pull-actuator.

19. The fiber optic module of claim 15 wherein the second engaging end includes a latch to engage the pivot-arm actuator to the pull-actuator.

20. The fiber optic module of claim 15 wherein  
the second engaging end includes a ramped sliding surface  
to slide and cause the pivot-arm actuator to rotate when the  
pull-actuator is pulled.

21. The fiber optic module of claim 13 further  
comprising:  
a spring to cause the pivot-arm actuator to return to its  
initial position when the pulling force on the pull-actuator  
is removed.

22. The fiber optic module of claim 21 wherein  
the spring is a leaf spring and part of the pivot-arm  
actuator.

23. The fiber optic module of claim 21 wherein  
the spring causes the pull-actuator to return to its  
initial position when the pulling force on the pull-actuator  
is removed.

24. The fiber optic module of claim 1 wherein the pull-  
actuator permits arranging multiple fiber optic modules in a  
belly-to-belly configuration without obstructing adjacent  
pull-actuators.

25. The fiber optic module of claim 24 wherein with the  
belly-to-belly configuration, two pull-actuators are located  
in proximity to each other along a common surface between two  
fiber optic modules.

26. A pull-actuator for fiber optic modules. the pull-

2 actuator comprising:  
3 a pull-tab;  
4 a pull-arm coupled to the pull-tab at a first end; and  
5 a catch at another end of the pull-arm to latch to a  
6 second actuator.

1 27. The pull-actuator of claim 26 wherein  
2 the pull-actuator slides to cause the second actuator to  
3 disengage a fiber optic module from a cage assembly.

1 28. The pull-actuator of claim 26 wherein pulling the  
2 pull-actuator causes the second actuator to release a fiber  
3 optic module from a cage assembly.

1 29. The pull-actuator of claim 26 wherein  
2 the pull-actuator includes one or more grooves to  
3 slideably engage a fiber optic module.

1 30. The pull-actuator of claim 26 wherein  
2 the pull-actuator includes  
3 one or more end-stops to withdraw a fiber optic  
4 module as the pull-actuator is pulled.

1 31. The pull-actuator of claim 26 wherein  
2 the pull-actuator includes  
3 one or more end-stops to prevent the pull-actuator  
4 from becoming disengaged from a fiber optic module as it is  
5 pulled.

1 32. The pull-actuator of claim 26 wherein the pull-tab  
2 includes an orientation indicator to indicate a fiber optic  
3 module which the pull-actuator releases.

33. The pull-actuator of claim 26 wherein the second actuator is a pivot-arm actuator which pivots to disengage a fiber optic module from a cage assembly when the pull-actuator is pulled.

34. The pull-actuator of claim 26 wherein the pull-actuator permits arranging multiple fiber optic modules in a belly-to-belly configuration without obstructing adjacent pull-actuators.

35. The pull-actuator of claim 34 wherein with the belly-to-belly configuration, two pull-actuators are located in proximity to each other along a common surface between two fiber optic modules.

36. A pivot-arm actuator for fiber optic modules having one or more electro-optic transducers, the pivot-arm actuator comprising:

a pivot arm which causes a fiber optic module to be released from a cage assembly when a pull-actuator is pulled; and

a pivoting pin to rotationally couple the pivot arm to a fiber optic module.

37. The pivot-arm actuator of claim 36 wherein the pivot arm includes,

a first engaging end with a keeper to engage a fiber optic module to a cage assembly.

38. The pivot-arm actuator of claim 36 wherein the pivot arm includes,

3 a first engaging end with a latch to engage a fiber optic  
4 module to a cage assembly.

1 39. The pivot-arm actuator of claim 36 wherein the pivot  
2 arm includes,

3 a second engaging end, opposite the first engaging end,  
4 with a keeper to engage the pivot-arm actuator to a pull-  
5 actuator.

1 40. The pivot-arm actuator of claim 36 wherein the pivot  
2 arm includes,

3 a second engaging end, opposite the first engaging end,  
4 with a latch to engage the pivot-arm actuator to a pull-  
5 actuator.

1 41. A pull de-latch mechanism for fiber optic modules,  
2 the pull de-latch mechanism comprising:

3 a pull-actuator; and

4 a pivot-arm actuator coupled to the pull-actuator at a  
5 first end, wherein pulling the pull-actuator causes the pivot-  
6 arm actuator to rotate thereby releasing a fiber optic module  
7 from a cage assembly.

1 42. The pull de-latch mechanism of claim 41 wherein the  
2 pivot-arm actuator includes

3 a ramped sliding surface at the first end which causes  
4 the pivot-arm actuator to rotate when the pull-actuator is  
5 pulled thereby releasing a fiber optic module from a cage  
6 assembly.

1 43. The pull de-latch mechanism of claim 41 wherein the  
2 pivot-arm actuator includes

3 a keeper at a second end, opposite the first end, to

4 couple the fiber optic module to a cage assembly.

1 44. The pull de-latch mechanism of claim 41 wherein  
2 the pull-actuator includes  
3 an orientation indicator to indicate the fiber optic  
4 module which the pull-actuator releases.

1 45. The pull de-latch mechanism of claim 41 wherein,  
2 the pull-actuator includes grooves to slideably engage a  
3 fiber optic module.

1 46. The pull de-latch mechanism of claim 41 wherein  
2 the pull-actuator includes  
3 one or more end-stops to withdraw the fiber optic  
4 module as the pull-actuator is pulled.

1 47. The pull de-latch mechanism of claim 41 wherein  
2 the pull-actuator includes  
3 one or more end-stops to prevent the pull-actuator  
4 from becoming disengaged from the fiber optic module as it is  
5 pulled.

1 48. The pull de-latch mechanism of claim 41 wherein the  
2 pull de-latch mechanism permits arranging multiple fiber optic  
3 modules in a belly-to-belly configuration without obstructing  
4 adjacent pull de-latch mechanism.

1 49. The pull de-latch mechanism of claim 48 wherein the  
2 belly-to-belly configuration two pull-actuators are located in  
3 proximity to each other along a common surface between two  
4 fiber optic modules.



1        50. A fiber optic module comprising:  
2        means for converting optical signals into electrical  
3        signals or electrical signals into optical signals; and  
4        means for disengaging the fiber optic module from a cage  
5        assembly by pulling a pull-actuator.

1        51. The fiber optic module of claim 50 further  
2        comprising:  
3        means for slideably engaging the means for disengaging  
4        the fiber optic module.

1        52. The fiber optic module of claim 50 wherein the means  
2        for disengaging also provides a means for withdrawing.

1        53. The fiber optic module of claim 50 further  
2        comprising:  
3        means for withdrawing the fiber optic module.

1        54. The fiber optic module of claim 50 further  
2        comprising:  
3        means for pivotally disengaging the fiber optic module  
4        from a cage assembly when the pull-actuator is pulled.

1        55. The fiber optic module of claim 54 further  
2        comprising:  
3        means for coupling the pivotally disengaging means to the  
4        fiber optic module.

1        56. The fiber optic module of claim 50 further  
2        comprising:  
3        means for indicating the fiber optic module which the

4 means for disengaging releases.

1 57. A method for disengaging and withdrawing a fiber  
2 optic module from a cage assembly comprising:  
3 pulling a pull-actuator to disengage the fiber optic  
4 module from the cage assembly; and  
5 continuing to pull on the pull-actuator to withdraw the  
6 fiber optic module from the cage assembly.

1 58. The method of claim 57 comprising:  
2 releasing the pull-actuator if the fiber optic module has  
3 been released from the cage assembly.

1 59. A fiber optic module comprising:  
2 a nose receptacle including  
3 a fiber optic cable receptacle to receive one or  
4 more fiber optic cable plugs,  
5 a pull-actuator to release the fiber optic module  
6 from a cage assembly using a pull action;  
7 a pivot-arm actuator coupled to the pull-actuator,  
8 the pivot-arm actuator to pivot and release a keeper from a  
9 latch to release the fiber optic module in response to a pull  
10 action on the pull-actuator; and  
11 a printed circuit board including one or more  
12 electro-optic transducers to convert optical signals into  
13 electrical signals or electrical signals into optical signals.

1 60. The fiber optic module of claim 59 wherein,  
2 the fiber optic module is a small form pluggable (SFP)  
3 fiber optic module and the cage assembly is a small form  
4 pluggable (SFP) cage assembly.

1 61. The fiber optic module of claim 59 further

2 comprising:

3 a housing to couple to the nose receptacle and cover the  
4 printed circuit board.

1 62. The fiber optic module of claim 61 wherein,  
2 the housing is shielded to protect the printed circuit  
3 board from electromagnetic interference.

1 63. The fiber optic module of claim 59 wherein,  
2 the pull-actuator includes one or more grooves to  
3 slideably engage the nose receptacle.

1 64. The fiber optic module of claim 59 wherein,  
2 the pull-actuator slides outward to release the fiber  
3 optic module from the cage assembly.

1 65. The fiber optic module of claim 59 wherein,  
2 the pivot-arm-actuator includes  
3 a pivot pin rotationally coupled to the nose receptacle  
4 at first and second ends to allow the pivot-arm actuator to  
5 pivot.

1 66. The fiber optic module of claim 59 wherein  
2 the nose receptacle further includes  
3 a spring coupled to the pivot-arm-actuator at a first end  
4 and the nose receptacle at a second end, the spring to exert a  
5 force on the pivot-arm-actuator to exert a return force on the  
6 pull-actuator.

1 67. The fiber optic module of claim 59 wherein,  
2 the pull-actuator includes  
3 an orientation indicator to indicate the fiber optic

4 module which the pull-actuator releases.

1 68. The fiber optic module of claim 59 wherein,  
2 the pull-actuator includes  
3 a pull-tab,  
4 a shaft coupled to the pull-tab at a first end, and  
5 a catch at a second end of the shaft.

1 69. The fiber optic module of claim 59 wherein,  
2 the pull-actuator is located at a bottom side of the  
3 fiber optic module.

1 70. The fiber optic module of claim 59 wherein,  
2 the nose receptacle further includes  
3 a grip to pull out on the fiber optic module.

1 71. A configuration of fiber optic modules having one or  
2 more electro-optic transducers, the configuration comprising:  
3 a printed circuit board having a first side and a second  
4 side;  
5 a first cage coupled to the first side of the printed  
6 circuit board to receive a first fiber optic module; and  
7 a second cage coupled to the second side of the printed  
8 circuit board to receive a second fiber optic module, the  
9 second cage aligned in parallel to the first cage such that a  
10 first belly of the first fiber optic module is adjacent a  
11 second belly of the second fiber optic module.

1 72. The configuration of claim 71 wherein,  
2 the first belly of the first fiber optic module being  
3 adjacent to the second belly of the second fiber optic module  
4 provides for increased density.

1 73. The configuration of claim 71, further comprising:  
2 the first fiber optic module having a first pull-actuator  
3 with a first orientation indicator;  
4 the second fiber optic module having a second pull-  
5 actuator with a second orientation indicator; and  
6 the first pull-actuator and the second pull-actuator each  
7 having a pull-tab offset from each other when the first belly  
8 is adjacent the second belly.

1 74. The configuration of claim 73 wherein,  
2 the first orientation indicator indicates the first fiber  
3 optic module and the second orientation indicator indicates  
4 the second fiber optic module.

1 75. The configuration of claim 73 wherein,  
2 the pull-tab is a pull button.

1 76. The configuration of claim 73 wherein,  
2 the pull-tab is a pull knob.

1 77. The configuration of claim 73 wherein,  
2 the pull-tab is a pull hook.

1 78. The configuration of claim 73 wherein,  
2 the pull-tab is a pull ring.

1 79. The configuration of claim 73 wherein,  
2 the pull-tab is a pull square.

1 80. The configuration of claim 73 wherein,  
2 the pull-tab is a pull mechanism.